1. An x-ray tube comprising:

(a) a cathode cylinder having an electron source disposed therein;

(b) an x-ray tube housing having an anode disposed therein, the anode having a target surface capable of receiving electrons emitted by the electron source;

(c) a shield structure positioned between the cathode cylinder and the x-ray tube housing, the shield structure defining an aperture through which the electrons are passed from the electron source to the target surface; and

(d) at least one fluid passageway disposed proximate to the shield structure, so that at least some heat from the shield structure is absorbed by the coolant as the coolant passes through the at least one fluid passageway, and wherein at least one depression is defined in at least one surface of the at least one fluid passageway and is at least partially in contact with the coolant, the at least one depression facilitating nucleate boiling of the coolant in the at least one fluid passageway.

2. The x-ray tube according to Claim 1, wherein at least one surface of the at least one fluid passageway comprises a plurality of extended surfaces being at least partially in contact with the coolant passing through the at least one fluid passageway, and the plurality of extended surfaces being oriented so that heat is transferred from the shield structure to the coolant.

3. The x-ray tube according to Claim 1, further comprising an aperture disk that cooperates with the shield structure to at least partially define the at least one fluid passageway, a surface of the aperture disk comprising a plurality of extended surfaces being at least partially in contact with the coolant passing through the at least one fluid passageway, and the plurality of extended surfaces on the aperture disk being oriented so that heat is transferred from the shield structure to the coolant.

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4. The x-ray tube according to Claim 1, further comprising an aperture disk that cooperates with the shield structure to at least partially define the at least one fluid passageway, a surface of the aperture disk defining at least one depression in contact with the coolant, the at least one depression facilitating nucleate boiling of the coolant in the at least one fluid passageway.

5. The x-ray tube according to Claim 1, wherein the at least one depression comprises at least one microgroove.

6. The x-ray tube according to Claim 5, wherein the at least one microgroove has a substantially "V" shaped cross section.

7. The x-ray tube according to Claim 1, wherein the at least one fluid passageway permits coolant to flow through a first section and a second section of the shield structure, and in a manner so that heat is transferred away from the first section at a greater rate than in the second section.

8. The x-ray tube according to Claim 1, wherein the shield structure is affixed to the x-ray tube housing with a braze material placed along a joint formed along both a horizontal and a vertical surface of the shield structure and the x-ray tube housing.

9. The x-ray tube according to Claim 1, further comprising a plurality of extended surfaces disposed on an outer surface of the shield structure, the plurality of extended surfaces being at least partially in contact with the coolant that has passed through the at least one fluid passageway, and the plurality of extended surfaces being oriented so that heat is transferred from the shield structure to the coolant.

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10. The x-ray tube according to Claim 9, wherein the plurality of extended surfaces disposed on the outer surface of the shield structure are formed integrally with the shield structure.

11. The x-ray tube according to Claim 9, further comprising a fluid flow conduit that directs at least a portion of the coolant that has passed through the at least one fluid passageway directly across at least a portion of the plurality of extended surfaces disposed on the shield structure so that heat is transferred from the extended surfaces to the directed coolant.

12. The x-ray tube according to Claim 9, wherein the shield structure and the extended surfaces disposed thereon are comprised of an aluminum oxide dispersion strengthened copper alloy.

13. The x-ray tube according to Claim 1, wherein the at least one fluid passageway is formed as a fluid passageway that defines at least two fluid pathways within a bottom section of the shield structure.

14. The x-ray tube according to Claim 13, wherein the two fluid pathways are formed by matingly attaching a main body portion of the shield structure to an aperture disk.

15. The x-ray tube according to Claim 1, wherein the at least one fluid passageway is formed as a fluid passageway formed within a side of the shield structure.

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16. The x-ray tube according to Claim 15, wherein the fluid passageway formed within the side of the shield structure is formed between adjacent heat dissipation elements formed about the outer periphery of the shield structure when the shield structure is operably affixed to the x-ray tube housing.

17. The x-ray tube according to Claim 1, wherein the at least one fluid passageway comprises at least one fluid passageway formed within a bottom section of the shield structure, and at least one fluid passageway formed within a side of the shield structure.

18. The x-ray tube according to Claim 17, wherein the fluid passageway formed within the bottom section of the shield structure, and the fluid passageway formed within the side of the shield structure are in fluid communication with each other.

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19. An x-ray tube cooling system comprising:

(a) a reservoir containing coolant that is continuously circulated through the reservoir by an external cooling unit;

(b) a shield structure defining an aperture that allows electrons to pass from an electron source to a target anode and that prevents electrons that rebound from the target anode from re-striking the anode target;

(c) a coolant manifold having an inlet and an outlet port, the inlet port receiving coolant from the cooling unit;

(d) at least one fluid passageway defined at least partially by the shield structure, wherein the at least one fluid passageway receives coolant from the inlet port and discharges the coolant at the outlet port, the coolant absorbing heat from the shield structure as the coolant flows through the at least one fluid passageway; and

(e) means for facilitating nucleate boiling of the coolant in the at least one fluid passageway.

20. The x-ray tube cooling system according to Claim 19, wherein the means for facilitating nucleate boiling of the coolant in the at least one fluid passageway comprises at least one depression defined in at least one surface of the at least one fluid passageway, and the at least one depression being in contact with the coolant in the at least one fluid passageway.

21. The x-ray tube cooling system according to Claim 20, wherein the at least one depression comprises at least one microgroove.

22. The x-ray tube cooling system according to Claim 20, wherein the at least one depression has a substantially "V" shaped cross section.

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23. The x-ray tube cooling system according to Claim 19, further comprising a plurality of extended surfaces disposed on at least one surface of the at least one fluid passageway, the plurality of extended surfaces being at least partially in contact with the coolant directed through the at least one fluid passageway by the inlet port, and the plurality of extended surfaces being oriented so that at least some of the heat in the shield structure is transferred from the shield structure to the coolant passing through the at least one fluid passageway.

24. The x-ray tube cooling system according to Claim 23, wherein the plurality of extended surfaces comprises a plurality of microridges.

25. The x-ray tube cooling system according to Claim 23, wherein each of the plurality of extended surfaces has a substantially "V" shaped cross section.

26. The x-ray tube cooling system according to Claim 19, further comprising a plurality of adjacent extended fin surfaces that are disposed about the outer periphery of the shield structure, and wherein the outlet port directs at least a portion of the coolant passed through the at least one fluid passageway to flow across the surfaces of the fins, and thereby increase the rate of heat transferred from the shield to the directed coolant.

27. The x-ray tube cooling system according to Claim 19, wherein the at least one fluid passageway permits coolant to flow through a first and a second section of the shield structure, and in a manner so that heat is transferred away from the first section at a relatively greater rate than from the second section.

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28. The x-ray tube cooling system according to Claim 27, wherein the length of the fluid passageway in the first section is relatively shorter in length than the fluid passageway of the second section so that the rate of fluid flow through the first section is relatively greater than rate of fluid flow through the second section.

29. The x-ray tube cooling system according to Claim 27, wherein the cross-sectional flow area of the fluid passageway in the first section is greater than the cross-sectional flow area of the fluid passageway in the second section so that the rate of fluid flow through the first section is relatively greater than the rate of fluid flow through the second section.

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30. A method for cooling at least a shield structure portion of an x-ray tube comprising the following steps:

(a) providing at least a first fluid path and a second fluid path through a corresponding fluid passageway defined at least partially by the shield structure;

(b) directing a liquid coolant through an inlet to the first and the second fluid paths;

(c) causing nucleate boiling of at least a portion of the liquid coolant in the fluid passageway;

(d) discharging the liquid coolant from an outlet connected to the first and the second fluid paths;

(e) directing at least a portion of the discharged liquid coolant across a plurality of extended fin surfaces formed on an outside surface of the shield structure;

(f) circulating the liquid coolant through a cooling unit; and

(g) repeating steps (b) through (f).

31. The method according to claim 30, wherein the rate of liquid coolant flow through the first fluid path is greater than the rate of liquid coolant flow through the second fluid path.

32. In an x-ray generating apparatus comprising an evacuated envelope at least partially disposed within a reservoir containing coolant, and the envelope having mounted therein an electron source for generating an electron beam and a spaced apart rotatable anode target for receiving at least a portion of the electron beam, a shield assembly disposed between the electron source and the anode target, the shield assembly comprising:

(a) a shield structure defining an aperture therein for allowing the electron beam to pass from the electron source to the anode target;

(b) an electron collection surface disposed about the aperture and oriented in a manner so as to face the electron source; and

(c) an aperture disk, the aperture disk cooperating with the shield structure to at least partially define at least one fluid passageway so that coolant flowing through the at least one fluid passageway absorbs at least some heat from the shield assembly, and at least one depression being defined in at least one surface of the at least one fluid passageway and being in contact with the coolant so as to facilitate nucleate boiling of the coolant flowing through the at least one fluid passageway.

33. The shield assembly according to Claim 32, wherein the at least one depression comprises at least one microgroove of substantially "V" shaped cross section.

34. The shield assembly according Claim 32, further comprising a plurality of extended surfaces disposed on at least one surface of the at least one fluid passageway, the plurality of extended surfaces being at least partially in contact with the coolant as it flows through the at least one fluid pasageway.

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35. The shield assembly according to Claim 34, wherein the plurality of extended surfaces comprise a plurality of microridges each having a subtantially "V" shaped cross section.

36. The shield assembly according to Claim 32, wherein the shield structure is affixed to the evacuated envelope with a braze material placed along a joint formed along both a horizontal surface and a vertical surface of the main body portion and the evacuated envelope.

37. The shield assembly according to Claim 32, wherein the at least one fluid passageway permits coolant to flow through a first section and a second section of the main shield structure, and in a manner so that heat is transferred away from the first section at a relatively greater rate than from the second section.

38. The shield assembly according to Claim 32, further comprising a plurality of extended cooling surfaces disposed about the outer periphery of the shield structure, the second plurality of cooling surfaces at least partially defining at least a second fluid passageway when the shield structure is affixed to the evacuated envelope, a portion of the coolant circulation through the at least a second fluid passageway to facilitate removal of heat from the shield structure.

39. The shield assembly according to Claim 32, further comprising a plurality of adjacent and extended cooling surfaces disposed on an outer surface of the shield structure, the extended surfaces being at least partially in contact with the coolant disposed within the reservoir so that at least a portion of the heat generated at the electron collection surface is transferred to the coolant via the plurality of cooling surfaces.

40. The shield assembly according to Claim 39, further comprising a fluid flow conduit that directs at least a portion of the coolant that has been discharged from the at least one fluid passageway across at least a portion of the plurality of extended cooling surfaces, so that heat is transferred from the extended surfaces to the directed coolant.

41. The shield assembly according to Claim 39, wherein the shield structure and the plurality of adjacent and extended cooling surfaces are comprised of an aluminum oxide dispersion strengthened copper alloy material.

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